CLAIMS

I/We claim:

[c1] 1. A method in a computer system for determining a pollutant load of a source at a selected confidence level, the method comprising:

receiving an indication of a control to be applied to the source, the control having a removal efficiency;

calculating an uncertainty ratio for the source at the confidence level based on coefficients of variation of an export coefficient and the removal efficiency, the uncertainty ratio indicating the portion of the load that will be generated by the source with the confidence level; and

calculating a determined load for the source based on the load and the calculated uncertainty ratio.

[c2] 2. The method of claim 1 wherein the source is a subwatershed that has multiple non-point sources of the pollutant and the control is applied to a specific non-point source.

[c3] 3. The method of claim 2 wherein the controlled non-point source is a land use and the control is a best management practice.

[c4] 4. The method of claim 1 wherein the calculating of the determined load is further based on a delivery ratio to a confluence point.

[c5] 5. The method of claim 4 wherein the delivery ratio factors in local delivery ratios of sources downstream from the source.

[c6] 6. The method of claim 4 wherein the calculating of the determined load is based on a water quality ratio and a retirement ratio.

[c7] 7. The method of claim 1 including calculating a trading ratio based on uncertainty ratios of two sources.

[c8] 8. The method of claim 1 wherein the uncertainty ratio is calculated by the following equation:

$$UR_i = \frac{\bar{L}_i}{\bar{L}_i\left[1 + z_\alpha * CVL_i\right]} = \frac{1}{1 + 2 * CVL_i}$$

where UR_i is the uncertainty ratio for subwatershed i, $\bar{L}_i$ is the mean load of subwatershed i, CVL_i is the coefficient of variation of the load of subwatershed i, and z_α is the z value at a certain confidence level.

[c9] 9. The method of claim 8 wherein the coefficient of variation of the load is calculated by the following equation:

$$CVL_i = \frac{\left(Var\left(L_i\right)\right)^{1/2}}{\bar{L}_i}$$

where CVL_i is the coefficient of variation of the load of subwatershed i, $Var(L_i)$ is the variance of the pollutant load of subwatershed i, and $\bar{L}_i$ is the mean load of subwatershed i.

[c10] 10. The method of claim 8 wherein the coefficient of variation of the removal efficiency for controls in series is represented by the following equation:

$$CV\eta_{ij} = \prod_{k=1}^{n_{ij}}\left(1 + \frac{Var(\eta_{jk})}{(1-\bar{\eta}_{jk})^2}\right)^{1/2}$$

where $CV\eta_{ij}$ is the coefficient of variation of the removal efficiency of land use j in subwatershed i, $Var(\eta_{jk})$ is the variance of the removal efficiency for BMP k in land use j, $\bar{\eta}_{jk}$ is the mean removal efficiency for BMP k in land use j, and n_{ij} is the number of BMPs of land use j in subwatershed i.

[c11] 11. A method in a computer system for determining a load of a pollutant of a source within a confidence level, the source having a load, the method comprising:

calculating an uncertainty ratio for the source at the confidence level based on a coefficient of variation representing an uncertainty in the load of the source, the uncertainty ratio indicating a portion of the load that will be generated by the source with the confidence level; and

calculating a determined load for the source based on the load and the calculated uncertainty ratio.

[c12] 12. The method of claim 11 wherein the coefficient of variation is based on an export coefficient.

[c13] 13. The method of claim 12 wherein the export coefficient is based on a land use of the source.

[c14] 14. The method of claim 12 wherein the calculating of the determined load is further based on a delivery ratio to a confluence point.

[c15] 15. The method of claim 14 wherein the delivery ratio factors in local delivery ratios of sources downstream from the source.

[c16] 16. The method of claim 14 wherein the calculating of the determined load is based on a water quality ratio and a retirement ratio.

[c17] 17. The method of claim 12 including calculating a trading ratio based on uncertainty ratios of two sources.

[c18] 18. The method of claim 12 wherein the uncertainty ratio is calculated by the following equation:

$$UR_i = \frac{\bar{L}_i}{\bar{L}_i\left[1 + z_\alpha * CVL_i\right]} = \frac{1}{1 + 2 * CVL_i}$$

where UR_i is the uncertainty ratio for subwatershed i, $\bar{L}_i$ is the mean load of subwatershed i, CVL_i is the coefficient of variation of the load of subwatershed i, and z_α is the z value at a certain confidence level.

[c19] 19. The method of claim 18 wherein the coefficient of variation of the load is calculated by the following equation:

$$CVL_i = \frac{\left(Var\left(L_i\right)\right)^{1/2}}{\bar{L}_i}$$

where CVL_i is the coefficient of variation of the load of subwatershed i, $Var(L_i)$ is the variance of the pollutant load of subwatershed i, and $\bar{L}_i$ is the mean load of subwatershed i.

[c20] 20. The method of claim 11 including receiving an indication of a control to be applied to the source, the control having a removal efficiency, wherein the coefficient of variation is based on the removal efficiency of the control.

[c21] 21. The method of claim 20 wherein the source is a subwatershed that has multiple non-point sources of the pollutant and the control is applied to a non-point source.

[c22] 22. The method of claim 21 wherein the controlled non-point source is a land use and the control is a best management practice.

[c23] 23. The method of claim 20 wherein the calculating of the determined load is further based on a delivery ratio to a confluence point.

[c24] 24. The method of claim 23 wherein the delivery ratio factors in local delivery ratios of sources downstream from the source.

[c25] 25. The method of claim 23 wherein the calculating of the determined load is based on a water quality ratio and a retirement ratio.

[c26] 26. The method of claim 20 including calculating a trading ratio based on uncertainty ratios of two sources.

[c27] 27. The method of claim 20 wherein the uncertainty ratio is calculated by the following equation:

$$UR_i = \frac{\bar{L}_i}{\bar{L}_i\left[1 + z_\alpha * CVL_i\right]} = \frac{1}{1 + 2 * CVL_i}$$

where UR_i is the uncertainty ratio for subwatershed i, $\bar{L}_i$ is the mean load of subwatershed i, CVL_i is the coefficient of variation of the load of subwatershed i, and z_α is the z value at a certain confidence level.

[c28] 28. The method of claim 20 wherein the coefficient of variation of the load is calculated by the following equation:

$$CVL_i = \frac{\left(Var\left(L_i\right)\right)^{1/2}}{\bar{L}_i}$$

where CVL_i is the coefficient of variation of the load of subwatershed i, $Var(L_i)$ is the variance of the pollutant load of subwatershed i, and $\bar{L}_i$ is the mean load of subwatershed i.

[c29] 29. The method of claim 20 wherein the coefficient of variation of the removal efficiency for controls in series is represented by the following equation:

$$CV\eta_{ij} = \prod_{k=1}^{n_{ij}} \left(1 + \frac{Var(\eta_{jk})}{(1-\bar{\eta}_{jk})^2}\right)^{1/2}$$

where $CV\eta_{ij}$ is the coefficient of variation of the removal efficiency of land use j in subwatershed i, $Var(\eta_{jk})$ is the variance of the removal efficiency for BMP k in land use j, $\bar{\eta}_{jk}$ is the mean removal efficiency for BMP k in land use j, and n_{ij} is the number of BMPs of land use j in subwatershed i.

[c30] 30. A method in a computer system for determining equivalency of loads of a pollutant of a source, the method comprising:

providing a load for two sources;

calculating an uncertainty ratio for each source at a confidence level, an uncertainty ratio indicating a portion of a provided load that will be generated by the source with the confidence level; and

generating a trading ratio based on the calculated uncertainty ratios, the generated trading ratio indicating a relative equivalency of the provided loads of the sources.

[c31] 31. The method of claim 30 wherein the provided load of one source represents an available credit and the provided load of the other source represents a needed credit.

[c32] 32. The method of claim 30 wherein a provided load factors in the uncertainty ratio of the source.

[c33] 33. The method of claim 32 wherein the provided load factors in a delivery ratio of the provided load to a confluence point.

[c34] 34. The method of claim 30 wherein the uncertainty ratio is based on uncertainty in export efficiency of the source.

[c35] 35. The method of claim 34 wherein the uncertainty in the export efficiency is represented by a coefficient of variation.

[c36] 36. The method of claim 30 wherein the uncertainty ratio is based on uncertainty in removal efficiency of a control.

[c37] 37. The method of claim 36 wherein the uncertainty in the removal efficiency is represented by a coefficient of variation.

[c38] 38. The method of claim 30 wherein the uncertainty ratio is based on uncertainty in export efficiency of a source and removal efficiency of a control applied to the source.

[c39] 39. The method of claim 30 wherein the generated trading ratio is also based on delivery ratios of the provided loads to a confluence point.

[c40] 40. The method of claim 39 wherein the generated trading ratio is based on a water quality ratio of a source.

[c41] 41. The method of claim 39 wherein the generated trading ratio is based on expiration ratio of a source.

[c42] 42. A method in a computer system for presenting results of a water quality analysis, the method comprising:

providing earned credit information for a plurality of sources;

displaying a map representing the sources, each source having an area on the displayed map; and

displaying an indication of the provided earned credit information with the area of each of the plurality of sources.

[c43] 43. The method of claim 42 wherein the earned credit information represents the earned credit load of each source.

[c44] 44. The method of claim 43 wherein the earned credit load represents a portion of a load generated by a source that is delivered to a confluence point.

[c45] 45. The method of claim 43 wherein the earned credit load factors in an exchange ratio.

[c46] 46. The method of claim 45 wherein the exchange ratio is based on an uncertainty ratio of a load generated by a source.

[c47] 47. The method of claim 45 wherein the exchange ratio is based on a delivery ratio of the load delivered to a confluence point.

[c48] 48. The method of claim 43 wherein the earned credit information includes uncertainty information associated with the earned credit load.

[c49] 49. The method of claim 42 wherein each source is a watershed.

[c50] 50. The method of claim 42 wherein each source is a subwatershed.

[c51] 51. A method in a computer system for presenting pollutant loads, the method comprising:

providing estimated loading information for a plurality of sources, the estimated loading information factoring in a control applied to a source;

displaying a map representing the sources, each source having an area on the displayed map; and

displaying an indication of the estimated loading information with the area of each of the plurality of sources.

[c52] 52. A computer system for assisting in trading of water quality relating to a pollutant, including:

an information store providing information related to subwatersheds and confluence points, including point sources and non-point sources of the pollutant and uncertainty information;

a component that allows a user to select a confidence level and that calculates pollutant loading of a subwatershed based on the point sources and non-point sources factoring in the uncertainty information; and

a component that displays a map of the subwatersheds along with the calculated pollutant loading.

[c53] 53. The computer system of claim 52 wherein the pollutant is phosphorus.

[c54] 54. The computer system of claim 52 wherein the system can be used for different types of pollutants.

[c55] 55. The computer system of claim 52 wherein uncertainty information relates to export coefficients of non-point sources.

[c56] 56. The computer system of claim 52 wherein the uncertainty information relates to removal efficiency of a control applied to a source.

[c57] 57. The computer system of claim 56 wherein controls are applied in parallel.

[c58] 58. The computer system of claim 56 wherein controls are applied in serial.

[c59] 59. The computer system of claim 52 wherein the component that displays is a GIS-based component.

[c60] 60. The computer system of claim 52 wherein the pollutant loading represents contribution of the subwatershed to a confluence point.

[c61] 61. The computer system of claim 60 wherein the pollutant loading factors in the delivery ratio to the confluence points.